The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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Export Research

MANY things are important in operating a business successfully. In technical arts, such as that of chemical manufacture, the technical men are prone to consider that theirs is the most essential part of the undertaking. It is true, of course, that unless production is efficient, the undertaking cannot prosper. Technical skill is the first essential, without which no undertaking can even hope to start in the chemical field and in many other fields—it is almost accurate to state that as a universal truth in to-day's conditions. But there is another partner whose work is complementary end equally important—that of the salesman. The modern scientific salesman must not be confused with the old-time carpet-bagger. Sales technique is specialised and employs many weapons. One of these is advertising; another is market research; a third is that somewhat indefinable asset of personal contact between buyer and seller on which is built up an edifice of mutual respect and reliance. These tools, as we may term them, are of importance in the home trade and are essential in the export market. Unfortunately, distance has too often prevented sufficiently intimate personal contact and likewise has made market research difficult and uncertain. British trade has thereby lost heavily.

A move is announced which will bring about a change if it operates as its sponsors intend. After several months of negotiation a project is taking shape for setting up a self-supporting, non-profit-making Export Research Association. The project is still in the embryo stage, but it has been developed far enough for the sponsors to feel able to ask business firms whether or not they are prepared to act as godparents to such an association. The project in question has been fathered by the Advertising Association; and it is linked with a plan for the creation at the same time of a National Overseas Advertising Service. This is the first real intimation that there is beginning to be an appreciation of the vital connection between market research and commercial efficiency. In 1941 the Government set up Export Groups in most industries, which were intended to be the spearhead of a great drive to obtain more exports in order to provide currency for the purchase of munitions. The Lease-Lend arrangement removed the necessity for this drive and permitted us to put our whole indus-

On Other Pages

trial potential into the drive for munitions of war. When later our store of munitions began to be adequate and we could have exported a certain proportion of our production, the operations of Lease-Lend acted as a brake and to some extent shut us out of the world's markets. The result is that old contacts have been broken and the realisation of our foreign capital assets has increased the need for export to an extent which would have been almost unbelievable only a few years ago. While it may seem odd to some people that the Advertising Association should sponsor this project and that the initiative should have come from industry, it must be remembered that advertising is an integral part of the process of production and marketing, and that many of the advertising agencies have amassed a fund of specialised knowledge of many markets and of the complete technique of assessing the needs of the consumer. By proceeding in this way, therefore, the nucleus of the proposed merchanting research service is already formed.

The Association is not intended to duplicate the work of existing organisations such as trade associations and Chambers of Commerce, nor is it suggested that it should fulfil any of the functions of the Government services. It would, however, investigate, for any project in any oversea market, such things as the suitability of design, local methods of usage, price structures, brand names, and the extent and acceptance of competing products and similar manufactures. To achieve this purpose the Association would utilise the customary machinery of modern scientific salesmanship, such as questionnaires, investigation squads, statistical analyses, assessments of reports. It is hoped to establish in every territory a branch or an association to which British trade would either resort or refer.

Any research is bound to be expensive and one of the problems of marketing research is that it is needed just as much by the little man who aims to export some of his products as by the big firm. A big firm may have its own intelligence service, it may have its agencies in all parts of the world, and at considerable expense it may very well run what amounts to its own marketing research department. The small man cannot possibly afford to do this because market research resembles scientific research in that the problems that arise are not always susceptible of solution, and it may cost a lot of money to obtain as many of the facts as happen to be available. To bring the cost of research within the economic range of the majority of firms, therefore, some means is needed of spreading the prime outlay over the greatest number of potential users. It has been stated that a precise figure cannot yet be given as to the likely cost of the service, but with reasonable support from manufacturers, merchants, and traders, the sponsors are prepared to go to registration on the basis of a guaranteed subscription of £500 a year for three years from founder members (who would have the right to nominate the first members of the council of the Association, but no other privileges) and £100 a year for ordinary members. Neither figure is likely to strain the resources of most firms. For the rest, of course, the more numerous the membership of the Association, the lower will be the unit costs and the better the quality of the services it can offer.

It is impossible to assess the probable value of this movement without knowing more about it than has yet been published. It would appear, however, to have very important possibilities if it is properly handled, and the fact that it is sponsored by the Advertising Association appears to make it probable that it would at any rate start with a good initial drive. No doubt the governing board of the new Association will be drawn equally from industry and from among advertising specialists. Much depends upon the harmonious collaboration of those who obtain the information and those who have to use it, and upon their exact knowledge of each other's various requirements. This country can afford to neglect no step in the prosecution of our export trade. If the Government will take a hand in this scheme, as it does in the scientific research associations, there will be some guarantee that it will be used to good advantage. We feel sure that industry generally, and the chemical and chemical plant industries not less than others, will examine carefully the possibilities of working through this Association.

NOTES AND COMMENTS

"Master Key" Publicity

A GOOD example of the way in which public attention is being directed to the importance of technical industries after the war is afforded by the comments which William Barkley has made, in the *Daily Express* recently, on Mr. Norman Sheldon's plan for the the "Master Key" Industries. We suppose that Mr. Barkley's *Notebook* is read by a great number of people who otherwise would not hear very much about the chemical and allied industries; and we are particularly glad that Mr. Sheldon's plan has thus been brought to the notice of a wider audience than the technical press can hope to muster. We have published Mr. Sheldon's plan in full, and we do not propose to repeat it here; but we should like to comment on what seems to us the most important sentence in the Barkley *Notebook*; this is where the author says, in reference to the "Master Key" plan: "I can understand this." That, in our view, is where Mr. Sheldon scores heavily; there is nothing abstruse about his scheme; it is plain and straightforward, besides being workable. Extra proof of its practicability, if proof were needed, is provided by the fact that he has met with opposition, has been severely criticised for suggesting control of German production, and even accused of "going against the Atlantic Charter." Well, at all events, this gives us a line on how post-war German propaganda is going to be worked; and so long as Mr. Barkley and his readers remain convinced "Sheldonians," we shall have a useful pack of watchdogs keeping an eye open for German tricks.

Production Boards

IT seems generally admitted that the regional boards set up by the Ministry of Production have fulfilled their function with a large measure of success; the only pity is, in fact, that they were not in existence some two years earlier. A fairly exhaustive account of the subject is included in the recently-published report of the Select Committee on National Expenditure, issued as a White Paper (H.M.S.O.; 2d.). As so often in this country, many of the major difficulties have been overcome by reason of the personal character of the chairmen of the boards; in some cases, resistance from some members of the Supply Departments was encountered, but this personal effort, abetted by a good response from the regional controllers of the Supply Departments and the Ministry of Labour, soon found methods whereby the difficulties could be adjusted. Some manufacturers, it was found, were still ignorant of the existence of the boards, or at least of their function, and made a practice of dealing direct with the Ministries. The committee appears satisfied that the widespread undertakings of the boards could not have been performed better by any other arrangement, and that their task has been carried out in a manner consistent with war efficiency. Whether they shall be allowed to continue in existence after the war is another matter; but in the event of the formation of a National Industrial Board, such as is envisaged by the Barlow Commission, it is more than likely that valuable advice could be furnished by local advisory committees constructed on the lines of the present regional boards and district committees, supplemented by something in the nature of industrial groups.

Capacity Offices

ONE adverse criticism which the committee has to make concerns the Capacity Offices, which, it is frankly stated, have not fulfilled the high hopes that were originally entertained of them. Here again, the fact that the Ministry of Production appeared late in the day had an adverse effect. The trouble arose from both ends. Most of the larger firms, of course, have long had their own organisation for sub-contracting arrangements, and possessed a good knowledge of the type of smaller firm likely to be able to undertake the required work. Many smaller firms were reluctamt to declare their capacity, for fear lest, instead of receiving new work, their existing labour might be taken from them. Most disappointing of all is the small use that has been made of the Capacity Offices by the Supply Departments. As little as 10 per cent. of the small number of requests for capacity has come from Government

Departments, presumably also because the main lines of contracting were laid down by the Departments before the Ministry of Production had come into being. A great deal of information about industrial and manufacturing capacity has been laboriously compiled—much of it to little or no purpose—and if this information has been so little used in time of war, there is even less likelihood of its being taken advantage of under peace conditions. All that the committee recommends for the future, therefore, is that the capacity records should be kept in being, preferably in a simpler form, by a staff of technically well-informed officers.

Inorganic Fertilisers

ALTHOUGH the majority of progressive farmers are fully convinced of the efficacy of inorganic fertilisers, they are, as a rule, too well occupied with their business to be particularly vocal on the subject. On the other hand, the "organic or nothing" party have lost no opportunity of rushing into speech and into print. It is pleasing, therefore, to find a successful and practical farmer expressing his views on the subject in so authoritative a periodical as *Agriculture*, the journal of the Ministry of Agriculture. Mr. A. E. Brown, of Merston Manor and other farms in the Isle of Wight, states, in the August issue of that journal, his opinion of the popular belief that fertilisers of organic origin are necessary as plant food. In his view, such belief is biologically unsound. As he says, plants take up minerals, not organic substances, and the plant is Nature's agent for converting the minerals into the organic material which is necessary to sustain animal life. It is, in fact, the mineral element on which the plant lives. He aptly quotes Sir John Russell's well-known remark that "it seems strange that in this twentieth century there should still be people who think that ammonia derived from organic sources differs in some subtle way from ammonia . . . produced synthetically." Mr. Brown, too, gives short shrift to the humus question. "Long experience," he says, "has shown that provided good crops are consistently grown, the humus content of the soil can very well be left to take care of itself." A good workman, in farming as elsewhere, knows how to make use of the tools at his disposal.

Collective Research

COMMUNICATION No. 269, just issued by the Institution of Gas Engineers, deals with some factors affecting the future of the gas industry. Though in the main the problems considered are solely the concern of that industry, the remarks by Dr. J. G. King, director of the Gas Research Board, on "Research in Industry" are of more general application. He is a strong advocate of collective or centralised research, both from the point of view of economy of material, and because of the possibility of combining the gifts of the several individuals making up the research team. Experience has shown that, in his organisation, an expenditure of as little as £40 per annum on apparatus, chemicals, power, etc., per unit of staff, can be managed by centralising a large proportion of the research effort. The Gas Research Board have sound ideas for the expansion of their capabilities. Not only do they aim at obtaining young men of high qualifications, and providing them with scientific assistance and workshop facilities so that their abilities may be used to the full; but they also reckon on supplying an intelligence service to guide the reading and save the time of the research staff.

Outside Contacts

THE attainment of this last objective assumes the constitution of a Central Bureau by the D.S.I.R., in liaison with which the Gas Research Board would maintain a bibliographical and abstracting staff. In order to avoid the risk of insularity on the part of the collective research workers, the suggestion is made that its members should attend scientific meetings, each member being allotted a group of subjects; that they should join local scientific societies, to whom they would report at intervals on their work; and that regular contact should be kept with industry and with the staffs of other research institutions and of universities. As Dr. King says, a determined effort might have to be made to keep consistently to such a system, but it is certainly worth making, and there are few branches of the chemical and allied industries that could not with advantage consider how a plan of research on similar lines might be incorporated into their own research scheme.

Electrolytic Hydrogen Production

I—Electrical Conditions and Cell Design

by D. D. HOWAT, B.Sc., Ph.D., F.R.I.C., A.M.I. Chem.E.

HYDROGEN is one of the raw materials in a number of important processes in modern chemical engineering. A large volume of hydrogen is absorbed by the petroleum industry in the hydrogenation of oils for the production of high-octane fuel. Next in importance is the manufacture of synthetic ammonia. In the food industries, catalytic processes are employed to hydrogenate soft vegetable, animal, and fish oils, purifying and hardening them for the manufacture of margarine and cooking fats. Various other smaller quantities of hydrogen are used in the reduction of tungsten and molybdenum for the electric-lamp industry.

The commercial production of hydrogen may be effected by either of two main methods—by thermal reduction processes (utilising steam, water gas, or natural gas) or by electrolysis of water—the method selected depending upon a balance set up between local natural fuel resources, hydro-electric power schemes, and the quality of the gas required. In the U.S.A. and Canada plentiful supplies of natural gas have caused extensive developments in the use of this material as a source of hydrogen. Economically speaking, two factors are paramount: first, the availability of cheap electric power; and second, the specific gas purity demanded.

All catalytic processes—a valuable market for hydrogen—require very high gas purities. To obviate the poisoning of expensive catalysts and possible contamination of the products, sulphur, carbon dioxide, and carbon monoxide must, if possible, be eliminated from the hydrogen. Considerable capital and operating costs are involved in a purification process for hydrogen produced by one of the standard thermal reduction methods. On the other hand, electrolytic hydrogen is produced in a state of very high purity. As only minute quantities of oxygen are present in the hydrogen, no purification process need be employed, but should even these minute traces of oxygen be objectionable they may be easily removed by burning.

Large-scale demands for hydrogen in the U.S.A. have been met by the exploitation of the abundant resources of natural gas, the cheapness of this raw material allowing fairly elaborate purification to be undertaken economically. Here and on the European continent different natural conditions have promoted the more extensive development of the electrolytic process for high-purity hydrogen production, the increased power cost being compensated for by the elimination of a purification process. Two recent developments in electrolysis—the improvement in the design and performance of the bipolar filter-press cell, and the technique of high-pressure electrolysis—were pioneered in Europe and have not been adopted on a large scale in the U.S.A.

The Essential Reactions

Essentially, electrolytic hydrogen is produced by the ionic dissociation of water under the action of an electric current. Owing to the extremely poor conductivity of pure water, some chemical addition is required to increase the conductivity of the solution, and this addition agent must be of such a character that no undesirable by-products are formed during electrolysis. Alkali hydroxides have proved to be the only addition agents with the required properties. These electrolytes do not enter directly into the production of the gases, the actual cycle of reactions in the case of potassium hydroxide being as follows:

(1) Dissociation of the electrolyte under the action of the current: $2KOH = 2K^+ + 2(OH)^-$

(2) The potassium ion migrating to the cathode reacts with water to liberate hydrogen: $2K^+ + 2H_2O = 2KOH + H_2$.

(3) The hydroxyl ion migrating to the anode reforms water with the liberation of oxygen: $2(OH)^- = H_2 + O$.

Ordinary chemical calculations show

that for the decomposition of 1 lb. of water 1350 amp.-hours are required, the products being 0.112 lb. of hydrogen measuring 20.2 cu. ft. at N.T.P. and 0.89 lb. of oxygen measuring 10.1 cu. ft. at N.T.P. Many factors operate to interfere with the efficiency figures quoted above and the influence of some of these must be taken into account.

Electrical Conditions in Hydrogen Production

1. *Minimum Decomposition Voltage.*—The minimum decomposition voltage for water, according to thermodynamical calculations, is 1.23. The application of this voltage to the cell causes the water to decompose into its constituent elements which begin to collect at the respective electrodes. Before bubbles of the gases are released in appreciable quantities from the electrodes, a voltage considerably in excess of this figure must be applied.

2. *Over-voltage.*—Excess voltage representing the additional electrical energy required to liberate any given gas from a particular electrode, is called the "over-voltage." Over-voltage, essentially an electrode effect, varies with the nature of the electrode, the surface condition and texture of the electrode, the current density, time, and temperature. The over-voltage of any metal electrode is much lower when a metal is being evolved. Over-voltage is in all probability associated with some action occurring after the discharge of the ions but before bubbles of gas are evolved from the electrode. Hydrogen ions may penetrate into the interior of the metal of the electrode, forming a solid solution or a metallic hydride. Only when the surface layers of the metal are saturated is molecular hydrogen formed. The liberation of the bubbles is accompanied by the breaking up of the metallic surface and the expenditure of considerable energy to overcome the surface forces. Support for this hypothesis is given by the fact that over-voltage is relatively low for all metals exerting a high solvent action for hydrogen. Of the commercially available metals a low over-voltage is given by an iron cathode and a nickel-plated anode, the sum of the hydrogen and oxygen over-voltage being 0.13. A still lower hydrogen over-voltage is obtained with a cobalt-plated iron cathode, but this construction is much more expensive.

The surface condition of the electrodes plays a very important part in determining over-voltage, a highly-polished smooth surface requiring a very much greater over-voltage than the same metal in a porous, spongy form. The objection to the use of finely-divided spongy metal surfaces lies in the tendency to disintegration, with contamination of the diaphragm by minute metal particles.

Current density is an exceedingly important factor, over-voltage being at its minimum with low current densities. This condition is unfortunate from an operating point of view, necessitating the use of very large electrode areas and cell units. To give the maximum electrode area various methods of manufacture have been suggested, *e.g.*, electrodes with projections or laminations, or plates covered with wire mesh. A serious objection to all these methods of increasing electrode area is that current density is not uniform over the surface and, because of high intensity on the projections, the actual operative area may be smaller than with a flat plate.

3. *The Electrolyte.*—Sodium or potassium hydroxide solution constitutes the only economically possible electrolyte.

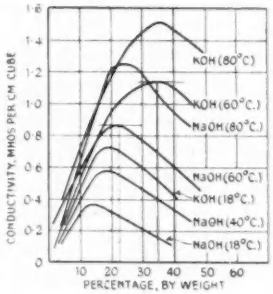


Fig. 1. Variation of conductivity of electrolyte with concentration (constant temperature). (BOWEN).

The curves in Fig. 1 show that at a constant temperature the conductivity curves for both chemicals pass through a maximum at a given concentration. The curves also indicate the marked increase in temperature up to 80° C., a value frequently employed in practice. Great attention must be paid to the purity of the electrolyte, the presence of chlorides being particularly objectionable, and a maximum chloride content of 0.25 per

cent. should be specified. The quality of the distilled water additions is also highly important; doubly distilled water, subsequently deaerated, is desirable to eliminate traces of carbon dioxide.

4. *Electrode Design.*—In any electrolytic process the surest way to reduce electrolyte resistance is to arrange for the closest possible approximation of the electrodes. Close attention is paid to the spacing of the electrodes in all cell designs, but in hydrogen production another important factor plays a part in determining the electrolyte resistance, namely, the formation and liberation of bubbles of hydrogen, oxygen, and even steam at the higher operating temperatures. Various methods of electrode construction have been adopted to eliminate bubbles as rapidly as possible, rapid circulation of the electrolyte also reducing the resistance due to bubbles. Great success has been claimed for certain designs of hollow electrodes allowing rapid elimination of gas bubbles from the path of the current. Employed most extensively in the filter-press cells, these electrodes are constructed with a solid plate, with a perforated forward plate set in close proximity to the diaphragm. The gas bubbles liberated pass up through the "dead" space between the perforated forward plate and the solid back of the electrode.

5. *Current Efficiency.*—Current efficiency is the ratio of the products actually obtained to the quantity of products theoretically obtainable. High current efficiencies, usually from 99 to 100 per cent., are obtainable without difficulty in well-designed modern cells. Factors lowering current efficiency are: (a) leakage of electricity; (b) loss of gas through cell joints; (c) mixing of the gases with resulting lowered purities; and (d) loss of electrolyte. Any appreciable drop in efficiency may be traced to one or other of these factors.

Cell Voltage

The actual cell voltage will depend upon a combination of all these factors discussed, *viz.*, the theoretical minimum decomposition voltage, the over-voltage, the electrolyte resistance, and the temperature. Obviously, the lower the cell voltage, the lower will be the total consumption of energy in gas production. Important points in cell design are involved in each factor mentioned and some of the practical details will be discussed in considering various types of cells.

Design and Construction

In all questions relating to the design and construction of cells the following points (given approximately in order of importance) must be considered: purity of the gases, electrical power efficiency, compactness, flexibility in operation, life of the cell, and capital and maintenance costs.

Purity of the gases is of paramount importance, failure to maintain the highest standards of purity leading to retardation of hydrogenation processes, poisoning of expensive catalysts, and reduction in yield and quality of products. Minimum purity figures usually specified are 99.5 per cent. for oxygen and 99.75 per cent. for hydrogen. Steinbrecher[1] lists the following causes of low gas purities:—

1. Holes in diaphragms or points of leakage between compartments large enough to allow gases to intermix.

2. Pronounced differences in the pressures of oxygen and hydrogen, causing flow of gas through the diaphragm owing to excessive differences in electrolyte levels.

3. Shorting of the electrode to the diaphragm owing to deposited impurities from the electrolyte.

4. Too low an electrolytic level in the cell, exposing parts of the diaphragm and allowing intermixing of gases.

5. Reversed polarity in the cell, which may arise from reversed polarity in the generator or where the generator voltage is less than the back E.M.F. of the bank of cells, caused by short-circuiting in a given cell.

6. Diaphragm acting as a bipolar electrode. The diaphragm may be rendered conducting by the application of twice the decomposition voltage to the cell.

Choice of suitable materials of construction bulks largely in the question of cell design. The caustic alkali solutions are highly corrosive, although mild steel is comparatively unaffected up to a temperature of about 80° C. This is one point at which a balance must be struck

between the increase in conductivity of the solution with temperature, and the increased attack of the alkali solutions. To reduce over-voltage to a minimum, nickel anodes or nickel-plated steel anodes are employed, the nickel being almost completely resistant to chemical attack by the alkalis. Cathodes are normally made of plain steel, but cobalt-plated sheets have been suggested.

The diaphragms, essential in all commercial cells to ensure gas purity, are commonly made of asbestos cloth, or asbestos with a wire-mesh backing. Shrinkage is the main trouble experienced with asbestos diaphragms, proving particularly objectionable in the filter-press type of cell. Nickel sheet perforated with a large number of very minute holes appears to have proved reasonably successful in one type of cell.

Suitable insulating material has presented the greatest difficulty of all, and attack on these materials may be electro-chemical or purely chemical. Alkalis are destructive to most plastics while the oxygen at the anodes destroys rubber. Asbestos cements are frequently employed, although ebonite is probably the best material. In the unit cells most of the insulation material may be kept

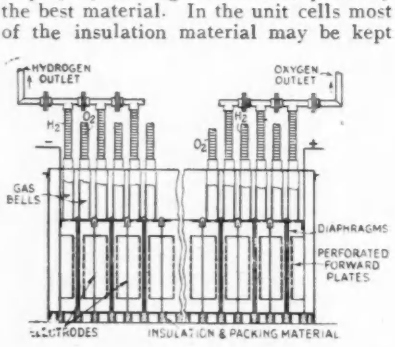


Fig. 2. Diagrammatic arrangement of diaphragms, electrodes, and perforated forward plates in a bipolar cell. (FISCHER).

above the level of the solution, but in the filter-press cells extensive contact occurs with the solution. This factor proves the most difficult of all the problems associated with these cells.

Bus-bar material presents some difficulties, copper being attacked by the alkali hydroxide solutions. Iron bar, the other obvious alternative, is unsuitable owing to the large cross-section required. The most practicable proposal is to use copper encased in a protective steel sheath or heavily nickel-plated.

Connections between cells for both solution and gas must be very carefully constructed to prevent current loss, glass tubing proving most useful. Fires and explosions may result from current leakage in connection pipes.

Types of Cell

Two distinct types of cells are possible, depending upon the arrangement of the electrodes, which may be in parallel or in series. The construction of the two types is radically different, each presenting certain operating difficulties. Parallel arrangement of the electrodes offers the simpler construction, the electrodes being assembled in pairs of opposite polarity in a suitably sized tank and connected individually to the common bus-bar. For the series arrangement a group of electrodes are assembled together within a framework in exactly the same way as a plate-and-frame filter press. The electrodes are separated by diaphragms, one side of each electrode acting as the cathode and the other as the anode. The major difficulty in this type of cell is the provision of suitable insulating and sealing material to form the joints around the edges of the electrodes. A diagrammatic sketch of a modern filter-press cell is shown in Fig. 2. Broadly speaking, the filter-press cell has been developed mainly in continental Europe and the unit or tank type of cell in Britain and the U.S.A. Different economic conditions obtain and the requirements of the gases produced vary, so that an accurate balance cannot be struck between the two types. In a rough comparison the following points may be listed regarding the two types of cell.

Advantages of Unit or Tank Cells

1. Ease of construction.
2. Elimination of the necessity to use any sealing materials. The electrolyte comes into contact only with welded metal joints.
3. Insulation troubles are considerably reduced as compared with the filter-press cell.
4. Ease of access for repairs, replacement, and maintenance.

5. Trouble with diaphragms is small. The diaphragms may be suspended freely in the electrolyte so that shrinkage troubles are eliminated.

6. Adequate and substantial support for the electrodes may be provided.

7. Failure of one cell does not involve shutting down the battery. With the parallel electrode arrangement the defective cell may be easily cut out of the circuit.

8. Reduction of risk of explosion by flashing or sparking due to current leakage. The voltage drop between any two cells is only in the vicinity of 2 volts, therefore dangerous flashing does not occur.

Disadvantages of Unit or Tank Cells

1. The voltage drop is greater than in filter-press cells.

2. The electrical generating and control gear is more expensive, as a low-voltage, high-amperage supply is required.

3. The cost of bus-bars and connections is high.

4. Circulation of the electrolyte is not so complete as with filter-press cells.

5. Current density cannot be maintained at a high value, largely owing to (4).

6 Greater floor space is occupied.

7. Maintenance of an even temperature throughout the electrotyte is difficult.

8. In open-top cells considerable contamination of the electrolyte occurs by absorption of carbon dioxide.

Advantages of Filter-press Cells

1. Circulation of the electrolyte is maintained. While introducing some complications so far as electrical leakage is concerned, this procedure has some real advantages.

2. High-current densities are maintained. This is the main result of (1), giving high cell capacities.

3. Easy temperature control of the electrolyte is rendered possible.

4. Floor space occupied is small in relation to capacity.

5. With the series arrangement the electrical supply is provided at high voltages.

6. Close approximation of the electrodes is possible.

7. The voltage drop is reduced, owing to (6).

8. A great saving in bus-bars and connections is effected.

9. The volume of the electrolyte required is small.

10. Gases may be delivered up to a pressure of 30 in. w.g., so eliminating the necessity for boosters.

Disadvantages of Filter-press Cells

1. Difficulty in securing suitable insulating and sealing materials for the joints between the electrodes. This is the most serious of the difficulties experienced with this type of cell.

2. Danger, from electrical leakage, or sparking in the circulation and pumping gear, with the attendant possibility of fire and explosion.

3. Danger of blockage in pipes, with possibility of cutting one cell out of commission.

4. Difficulty with diaphragms. Shrinkage and warping of diaphragms present a continual problem.

5. The necessity to shut down a complete battery of cells if failure occurs in one cell owing to a leaky diaphragm or defective insulation and sealing material.

6. The greatest care is necessary to keep the electrolyte free from any impurities, particularly mechanical impurities and frothing. Quite an elaborate filtration system is essential.

Treatment of Gases Evolved

The warm hydrogen and oxygen gases leaving the cells carry off entrained quantities of electrolyte spray and water vapour. Cooling the gases will result in the condensation of the greater part of the water vapour, but washing devices must be installed to remove traces of electrolyte. This problem is not so serious in the unit or tank cells as with the filter-press cells. Gas space above the electrolyte is much greater in the unit cells, the quantity of entrained electrolyte carried off being greatly reduced. Gas mains from the unit cells are made self-draining, tubular coolers or combined washers and coolers being installed at selected points. Washing and cooling of gases from the filter-press cells calls for greater care and attention. The gas space above the electrolyte is small and entrainment is usually pronounced. In one type, a separator, washer, and electrolyte cooler are em-

bodied in a reservoir. The electrolyte foam separates from the gases in a tubular separator, the gases passing upward and bubbling through distilled water in the top section. The distilled water, passing down through the separator in a spray, meets the recovered electrolyte before being pumped into the cell. Provision must be made to balance the water levels in the gas washers, or differences in pressure may be set up across the diaphragms, causing mixing of the gases. Boosters are frequently necessary when the gases are stored in holders, the gases from the cells being increased in pressure from 4 in. up to 10/12 in. water gauge. Filter-press cells may usually be arranged to work satisfactorily at pressures in excess of the 10/12 in. water gauge in the gas holder so that the necessity for boosters is eliminated.

(To be continued.)

Synthetic Oil in Spain

Extensive Long-Term Programme

WHEN the Anglo-American embargo on oil exports to Spain was imposed earlier this year, the Spanish Government announced its intention of establishing a liquid fuel industry based, on the one hand, on the country's large deposits of oil-shale, and on her considerable, yet little developed, coal and lignite resources on the other. Details of an ambitious long-term plan have just reached this country. As long ago as January, 1942, a decree was passed authorising the National Institute of Industry to take charge of the work, while the technical aspects of the project were to concern a semi-official company, the Calvo Sotelo. For nearly two years little more was heard of the plan, though preparatory and experimental work are reported to have gone on during that time. On May 26 this year, however, a law was published in the Boletin Oficial del Estado—the Spanish Official Gazette—concerning the establishment of a national Spanish liquid fuel industry.

Production is to be located in four main regions—Puertollano, Ebro, Puentes de Garcia Rodriguez, and Levante. For these regions, expenditure of two milliard pesetas has been authorised for the four-year period 1944-1947. This sum is to cover the construction of plant and facilities, such as electric power supply, mining equipment, and mine railways. To date, 1,156,000,000 pesetas have been earmarked for work in these regions. This 4-year plan seems to be only part of an extensive long-term development plan, which will extend over ten or even more years, with a total capital outlay of 20 milliard pesetas, an amount equal to roughly 4 per cent. of the national income.

In the Puertollano shale-oil district, a refinery plant is to be erected with an annual capacity of 1,200,000 tons of crude shale oil. This crude oil is to be refined in a second projected plant. Production of fertilisers, explosives and of other materials is also envisaged in this area. In the Ebro district, work is scheduled to proceed in two stages; the first includes the installation of mining equipment for the production of 500,000 metric tons of lignite annually, and the construction of a plant for its subsequent hydrogenation. In the second stage of the programme, lignite output is to be raised to a million tons a year. As in the Puertollano district, plant for the production of fertilisers, as well as facilities for the further utilisation of by-products, is to be provided here.

Dependence on Lignite

In the region of Puentes de Garcia Rodriguez, a low-temperature carbonisation plant is to be built—using local lignite as its raw material—with an annual capacity of about 100,000 tons of liquid fuel. In the second stage, an increase in the output of lignite to 400,000 tons a year, and the construction of a hydrogenation plant are planned. Finally, in Levante, a refinery is to be erected, to be charged with either crude imported or domestic products.

Published comments dwell on the long-term nature of the programme which depends, first of all, on an increased lignite output. A wide range of heavy equipment and special machinery would be needed, and an adequate number of technicians and workers would have to be trained or else called in from abroad. A successful realisation of even part of this vast programme would undoubtedly result in the creation of an important chemical industry in Spain with a corresponding decline in imports. Against this has to be set, of course, the effect of the resumption of the international trade in oil and oil products after the war. Although supported by the Government, the programme has to be viewed with a certain amount of caution. In any case, time will show whether or not the Spanish Government, in promulgating and pursuing such plans, has been building "castles in Spain."

The Union of South Africa is now self-supporting in tin, and there have been no imports of this metal since the Non-Ferrous Material Control started in February, 1942. Tin concentrates produced in the Union and in the neighbouring countries, including Uganda and Tanganyika, are smelted in the Union, and ingots produce compare most satisfactorily with those formerly produced by Malaya and Britain.

SAFETY FIRST

Safety with Gases in Cylinders

by JOHN CREEVEY

STEEL cylinders, as employed for the storage and convenient use of compressed gases, are constructionally sturdy and have to pass severe safety tests before being put into service; nevertheless, they must be treated with due care by all who handle them.

In storage, cylinders must be protected against excessive variation of temperature; avoid the direct rays of the sun in summer and (if in the open air) afford some protection against an accumulation of snow or ice in winter. A cylinder store should be built with fire-resisting and heat-resisting walls and partitions; for safety against fire an isolated building is to be preferred. In no case should cylinders be left lying in places where they may receive a blow from moving objects, *e.g.*, close to a gangway along which trucks are passing, or where anything may fall upon them from overhead, *e.g.*, beneath elevated platforms or at the foot of stairways. Sudden impact from a moving or falling object may cause the cylinder to rupture at a weakened point, with consequent "explosion" of the gaseous contents which are under pressure.

Always keep full cylinders and empty cylinders in separate parts of the store. Never allow a cylinder, whether in storage or in use, to be exposed continuously to dampness, or to the action of corrosive chemicals or chemical fumes. Avoid situations where there may be leakage of liquid or water from overhead pipes, or the overflowing of a tank. Be especially watchful for the inconspicuous steady drip of rainwater from a leaky roof. Corrosion of a cylinder may proceed slowly enough, but there is a steady and continuous weakening of the metal.

Transport of Cylinders

When moving cylinders from place to place, make use of a special trolley, to which the cylinder can be securely fixed and which may be wheeled about safely. Exercise due care when mounting or descending a step; avoid stairways wherever possible, however short they may be. Where heavy cylinders have to be hoisted by lifting tackle, always use a cylinder cradle; rope or chain slings must not be used, as there is always danger of a cylinder slipping, when impact with the ground may cause rupture. Avoid lifting a number of cylinders at the same time, unless they are lashed securely together to prevent one cylinder from knocking against another when being hoisted.

A cylinder that shows signs of leakage should receive immediate attention, the person concerned always wearing a gas mask with appropriate container for avoiding the effects of the particular gas. If possible, avoid moving a leaking cylinder without first endeavouring to close the valve and replace the cylinder cap. In some cases leakage may be due to foreign matter in the valve, thereby preventing proper closure; this foreign matter may be removed by slightly increasing the rate of discharge of the gas, and then endeavouring to close the valve. No inexperienced person should be allowed to handle a leaking cylinder.

The Importance of Valves

When a cylinder is empty, close the valve and replace the protecting cap before returning it to the cylinder store; indeed, replace the protecting cap whenever the cylinder is likely to be out of use for several days. The valve on a compressed gas cylinder is an essential part of the contrivance, which demands all possible care in keeping it in good working order. While cylinders are in commission, but not actually in use, it is recommended that the protecting cap be kept in place, unless this is not convenient because of a connection with plant or other equipment.

When in use, cylinders must be supported in a proper rack or ring stand, where they will be secure against accidental tipping or falling. Certain designs in cylinder trolleys, for conveniently moving a cylinder from place to place, also act as proper supports, and it is a wise investment to procure such equipment, even if one cylinder only is on the premises at any one time. The hazards which may arise in the use of that single cylinder may be just as fatal as if it were one of many.

Repairs to gas cylinders must be left to the attention of the makers; should it become necessary at any time to effect a minor repair for immediate safety, advice of this must be passed to the maker when the cylinder is returned. A cylinder which exhibits signs of danger should be allowed to discharge completely, as conveniently (as regards disposal of the gas) as possible, and then returned (with due advice) to the makers. Connections to cylinders must never be forced, if the screw threads do not engage smoothly. When the valve-protecting cap has been removed, the valve should be opened for an instant to clear the opening from particles of dust or dirt which may have gained access; this is most

essential before making any connection with equipment where the gas is to be used. Moreover, develop the habit of opening and closing all valves slowly.

Bear in mind the particular properties of the gases which are in use. Among inflammable gases are ammonia, acetylene, butane, ethylene, ethyl chloride, hydrogen, methyl chloride, and propane; those which are non-inflammable include carbon dioxide, chlorine, nitrogen, nitrous oxide, oxygen, and sulphur dioxide. Anæsthetic effects are produced on breathing acetylene, butane, ethylene, ethyl chloride, methyl chloride, nitrous oxide, and propane; irritant gases include ammonia, chlorine, and sulphur dioxide. The inflammable range, in admixture with air, varies considerably; it lies between 2.5 and 80 per cent. in the case of acetylene, is from 4.1 to 75 per cent. in the case of hydrogen, and from 16 to 26 per cent. with ammonia.

Industrial Dusts

The Prevention of Pneumoconiosis

A RECENT issue of the Bulletin of the National Association for the Prevention of Tuberculosis (December, 1943) was largely devoted to articles on the various aspects of pneumoconiosis, or lung disease caused by dust particles. The prevention of pneumoconiosis was dealt with by Dr. Thomas Bedford, of the Industrial Health Research Board, Medical Research Council. "Pneumoconiosis" is a group name covering such diseases as silicosis and asbestosis.

Silicosis is caused by the inhalation of siliceous dusts such as those of sandstone and quartz. It occurs, writes Dr. Bedford, in workers following a variety of occupations, principal among which are sandblasting, metal grinding, sandstone quarrying and working, slate quarrying, pottery manufacture, the manufacture of abrasive soap powders, metalliferous mining, and the driving of hard headings in coal mines.

The breathing of asbestos dust, usually over a long period, causes the disease known as asbestosis. Many coalminers engaged in hewing coal contract a disease somewhat similar.

Clearly, any measures designed to reduce or abolish the incidence of pneumoconiosis must aim at preventing the worker from breathing air laden with harmful dust. The methods by which protection from noxious air contaminants, including pneumoconiosis-producing dusts, may be achieved are, in order of preference: (i) substitution of the noxious substance by a harmless one; (ii) prevention of the escape of dangerous dust into the general atmosphere; (iii) copious general ventilation; and (iv) personal protection of the worker.

An example of substitution can be taken from the pottery industry. Powdered flint has long been used for the firing of china ware, and the workers who removed the ware after firing were exposed to flint dust which is a potent cause of silicosis. Manufacturers experimented to find a safe substitute and it appeared that alumina could be used satisfactorily in place of flint. In an investigation carried out by the Medical Research Council among men who had been exposed to alumina dust for many years no evidence of pneumoconiosis was found. Thus by using alumina in place of flint in this pottery process the risk of pneumoconiosis can at any rate be greatly reduced. Another instance of substitution is the extensive change-over from grindstones made of sandstone to artificial abrasive wheels in the grinding of metals.

Where the harmful substance must necessarily be used the escape of dust into the general atmosphere should be prevented if at all possible. As near as possible to the point of origin of the dust a suitably designed hood is placed, and from the hood a metal duct leads to a pressure fan which is made to pull air into the hood. The shape and location of the hood, the size of the duct, and the power of the fan are so arranged that the air-flow over the point at which the dust is generated is such as will ensure that the dust is drawn straight into the duct and transported to a suitable collecting device. Local exhaust hoods are commonly used with many types of rotary machinery, such as grindstones; they are also used in a variety of other processes such as, for example, stone dressing, rock crushing, and some operations in the pottery industry.

Sometimes it is practicable for the process to be completely enclosed. Often, as in rock-drilling and some metal grinding processes, the formation or dispersion of dust can be much reduced by the use of water.

In spite of precautions such as those described, it often happens that enough dust to constitute a hazard to health escapes into the air. In such cases generous ventilation must be provided, so that the suspended dust is dispersed in a large enough volume of air to ensure that its concentration does not reach a harmful level. There are other processes in which none of the methods will

suffice to maintain a safe atmosphere, and then respirators or other breathing apparatus must be worn by the operators, and the process must be segregated in special compartments. Sandblasting is such a process.

Statutory Requirements

There are statutory requirements concerning dust control in industry. The Factories Act, 1937, requires that provision shall be made for rendering harmless so far as practicable all dust, etc., that may be injurious to health; another section requires that means shall be taken for preventing the inhalation of dust, and a further section requires the exclusion of persons from workrooms in which siliceous dust is produced during the intervals allowed for meals or rest. In addition, various regulations have been made for the control of special industries or processes. Thus, briefly, sandblasting may only be done in an enclosed chamber in which no other work is ordinarily performed, and in which efficient means are provided to prevent the escape of dust outside the chamber: the sandblaster working in the chamber must wear overalls and a suitable protective helmet and gauntlets; the helmet must be provided with a supply of pure air and a way of escape for exhaust air, and must bear the mark of the person using it. Another set of regulations applies to processes carried out in quarries in which the stone contains at least 80 per cent. of silica. Machines used for the crushing and grinding of stone must be entirely enclosed, or be provided with efficient arrangements to prevent the escape of dust.

These examples of official regulations are enough to indicate the care that is required to protect industrial workers.

Dust Sampling

If one is to assess the risk of pneumoconiosis, or to decide on the efficacy of dust control measures, one must know something about the nature and quantity of the dust present in the air. In order to define an air-borne dust completely it is necessary to know the chemical and mineralogical nature of the dust, its concentration, and other physical characteristics. These physical characteristics include: the mass concentration *i.e.*, the weight of dust in unit volume of the dust cloud; the number of particles per unit volume; and the size distribution of the particles. Information about the size of the dust particles is very necessary because it is unlikely that many particles larger than about 10 microns (1 micron equals one-thousandth of a millimetre, or about 1/25,000th of an inch) reach the deeper parts of the lungs. The smaller dust particles are regarded as the more dangerous. Generally, in industrial dust clouds practically all the particles are much smaller than 10 microns. Thus, for example, the average size distribution for a large group of samples taken in one anthracite mine showed that 94 per cent. of the dust particles were below 5 microns in size, 75 per cent. were less than 2 microns and roughly 55 per cent. were smaller than 1 micron.

Various instruments have been devised for sampling air-borne dusts. Generally, those used for sampling pneumoconiosis-producing dusts are designed to entrap the dust particles from a known volume of air on a glass surface or in a liquid. The particles are then counted under the microscope, and in some cases the particle diameters are also measured and the particle size distribution thus ascertained.

Sampling Instruments

Dr. Bedford considers it unfortunate that the various available dust-sampling instruments differ considerably in their sampling efficiencies, so that for the same dust cloud different instruments may give substantially different results. (A discussion of the relative merits of such instruments was presented by Dr. S. C. Blacktin in THE CHEMICAL AGE, 1943, *48*, p. 575.) Therefore, in considering a stated dust concentration one should have regard to the methods of sampling employed. One of the sampling instruments designed in Great Britain, the thermal precipitator, is highly efficient. The dust is deposited on two microscope cover slips which are subsequently mounted on slides. Counting and measurement of the dust particles are done later under a high-power microscope. While, as has been indicated, some of the dust-sampling instruments now in use do not give extremely accurate information concerning dust concentrations, they have nevertheless been of inestimable value in controlling the dust hazard in many industries.

RECOVERY OF TIN

As a result of special research work on tin recovery, induced by the loss of Malayan tin supplies, the Australian Council for Scientific and Industrial Research has developed a new process for extracting tin from lode ores. It is reported that the new process promises to make possible the separation, from "tailings," of a large proportion of the tin not previously recoverable. Flotation replaces the gravitation method now customarily employed. Laboratory tests have achieved the recovery of a high proportion of metallic tin from ores which were difficult to treat. It is now planned to establish an experimental plant, and Mr. W. H. Williams, director of the Tasmanian Mines Department, has offered his department's aid in the commercial development of the process. (*Industrial Australian and Mining Standard.*)

Safe Production of Styrene

War-Time Lessons

SAFETY precautions that have been found necessary in the vastly increased production of styrene in the United States during the war were the subject of an address by H. K. Eckert, of the Monsanto Chemical Co. to the National Safety Congress recently held in Chicago. The styrene plant, he said, has the usual safety problems that are found in the chemical industry, plus a number of those common to the refining of petroleum. About styrene itself little information was available. A colourless liquid with a boiling point of 145° C., it has a peculiar gassy odour which provides ample warning of toxic concentration. It does not seem to produce the blood damage so characteristic of benzol and other ring compounds which styrene closely resembles in structure. In a series of several hundred periodic examinations of workers, no damage of that nature was found.

The principal toxic action of styrene seems to be that of irritation of the lungs upon inhalation and of the skin upon contact. Also to be considered is the fact that slight narcosis may be produced by inhaling small amounts of styrene, as with other aromatic hydrocarbons. Following exposure to high concentrations of styrene, with the accompanying respiratory tract irritation, there may also be liver and kidney damage. The eye and nose irritation produced by styrene serves as a warning of hazardous concentrations. At 200 parts per million a disagreeable odour is present, but eye and nose irritations should not be produced. It is believed that no serious health hazard should result in the case of repeated exposures to this concentration.

The Monsanto styrene plant at Texas City is so built that such concentrations are almost impossible to obtain. The entire plant is outdoors, with only the closed control houses inside the area where styrene is present. These control houses are built and ventilated so that a positive pressure is maintained inside them which does not allow the entrance of any vapours from the outside. This same arrangement also prevents toxic action from benzol, which is present in quantities as large as, or larger than, styrene. All the chemicals used have a distinctly corrosive action upon the skin, if men come in contact with them in even small quantities. A number of safety devices have been installed throughout the plant to handle accidents of this kind. All areas are equipped with safety showers, eye baths and fire blankets. Safety equipment, such as goggles, respirators, hard hats, rubber gloves and rubber suits, are furnished to the men wherever necessary. Mechanical guards have been placed on all machinery and equipment.

Detecting Mercury in Air

New American Apparatus

THE detection of mercury in air is an important consideration in factories where workers may be exposed to mercury and its compounds, which, as is well known, can constitute a dangerous health hazard. In U.S.P. 2,345,090, assigned by P. H. Brace, of Forest Hills, Pa., to the Westinghouse Company, two modifications of known methods are described.

In one of these, a sample of the air believed to be contaminated is drawn into a heated tube containing a porous plug of lime. This dissociates the mercuric compounds and produces a corresponding proportion of free mercury. The gases are cooled and allowed to travel over a transparent strip containing selenium sulphide. Free mercury present in the gases will cause a darkening of the strip in proportion to the percentage of the substance present. A beam of light is projected through the strip and on to a photo-electric cell. Attached to the cell is a recording mechanism which can be calibrated to read the amount of free mercury present.

Another method makes use of the principle that mercury vapour will absorb light of specific wavelengths, for example, 2537 Å. A beam of light from a low-pressure mercury arc lamp which emits light rich in the suitable wavelengths is passed through a chamber containing the collected mercury vapour and then allowed to impinge on a photo-electric cell. Suitable recording apparatus is connected to the cell.

Beeswax

Trade with U.S.A.

TRADERS in this country may now deal with any inquiries they may receive from United States importers for beeswax supplies from any source other than Tanganyika. Supplies from Tanganyika are, by agreement, directed solely to U.K. and Empire countries. This is consequent upon the announcement by the Office of War Information that with the removal of beeswax from the War Production Board Imports Order M.63, as amended June 22, 1944, United States importers of this commodity are no longer restricted to purchasing only in certain specified territories.

Maximum buying prices have been established by the Office of Price Administration for crude pure beeswax (i) imported from South and Central America, Mexico and the Caribbean area, 38 cents per lb., and (ii) imported from Africa, 31¼ cents per lb. (f.o.b. country of origin in both cases). Prices for territories not specifically referred to in the Maximum Prices Regulation are subject to approval by the Office of Price Administration.

Benn Brothers' Annual Meeting

Increased Dividend : Value of Trade Press

THE 48th annual general meeting of Benn Brothers, Ltd., proprietors of THE CHEMICAL AGE, was held at Bouverie House, Fleet Street, E.C.4, on August 11, Mr. Gordon Robbins, chairman of the company, presiding. Moving the adoption of the annual report and accounts, the chairman commended these documents to the shareholders as a satisfactory outcome of the year's work.

Revenue, he said, both from advertisements and from subscriptions and sales, is substantially higher than a year ago. So is expenditure, necessarily so in view of the increased volume of business, but much lower proportionately to revenue. This has brought the profit and loss account a handsome increment, largely for the benefit of the national Exchequer, which takes over £15,000 more than a year ago. There remains an increased net profit of nearly £3000 carried to the balance-sheet.

The directors have not only maintained the generous allocations of 1943, including £10,000 to general reserve and £14,000 to taxation reserve, but with the second now standing at £44,000 they have provided for every penny of taxation to be levied on the company in the next 18 months. Having paid a staff bonus for the third successive year and maintained the firm's scale of allowances for men in the Forces, the directors recommend an increase of 2½ per cent. in the ordinary dividend. This is no more than bare justice, as the ordinary shareholders suffered reductions amounting to 6 per cent. in the first two years of the war.

Support for Trade Journals

There is one clear inference to be drawn from these figures. Whatever else the manufacturer and merchant have given up during the war, they have decided that it would be a false economy not to maintain their full support of the Trade and Technical Press in order to receive in return a service of information and advice unobtainable from any other quarter. Indeed, the firm's figures suggest that the business community is showing a greater appreciation of the value of the Benn journals than ever before.

A shallow conception of the British Press, more prevalent in London than elsewhere, is that it consists of a few daily and Sunday papers and that any publication which cannot flaunt a net sales certificate of at least six figures does not count. I salute in all gratitude the mammoths of the newspaper world in whose service I spent a quarter of a century before being invited by Sir Ernest Benn to undertake the duties I have since discharged. If there is one lesson more than another which my combined experience has taught me, it is that the weeklies, which sustain the self-knowledge and self-respect of every local community in the British Isles, and the Trade Press, which this house buttresses with a thousand columns, are the backbone of the newspaper body. In healthiness of tone, in sanity of outlook, and in all trustworthiness, these two branches of the Press set an example.

Individual Enterprise

To vindicate such a claim as this, a publishing house has to base its activities on a well-grounded code of principles. As good newspaper men, our first technical aim is honesty of presentation. But we have views to express as well as news to record, and in this sphere we steadfastly adhere to the doctrine which has animated the house ever since its foundation by Sir John Benn 64 years ago. We proclaim, because we feel it in our bones, that individual enterprise is indispensable to the progress of British trade, which itself is the life-blood of the nation. As I can think of no better hallmark for the Benn journals at any time, it is strange that I should have to emphasise it at a moment when your board and headquarters' staff are again in the front line of the fight for the various freedoms to which the human spirit aspires. The reason reduced to its simplest terms, is that, amid much confusion of thought and illogical argument, we are consistent in our opposition to the totalitarian doctrine. We hate it as much in trade as we hate it in politics, and we will no more accept it from a sentimental economist at home than from a foreign dictator.

The Benn journals take their stand alongside the private trader, the small man, the little masters without whose drive and initiative British industry would not have led the world, and against the retention in peacetime of all the controls, quotas, licences, and other restrictions on individual effort which are loyally accepted now as one of the sacrifices demanded for the victorious prosecution of the war. Those, however, who are prepared to make all sacrifices for the war, whether they believe them to be justified or not, have the best title to insist upon the restoration of their old liberty of action when the fighting is ended. Accordingly, the firm's relations with a dozen or more Government departments are uniformly friendly. Still we hope that an early end of the war will give us, among more obvious advantages, the prospect of resuming our

traditional attitude of disinterested watchfulness to those which survive the next Geddes axe.

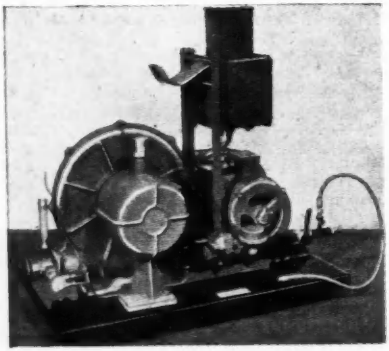
Over the vast industrial field covered by our 15 journals there is an expectant atmosphere, with the approaching end of the war after five years of turmoil and destruction on an unexampled scale. We shall be ready for the switch-over, and are prepared to find that the post-war position will bristle with more numerous and baffling problems than those with which we were suddenly faced in September, 1939. No trades have been more violently wrenched from their normal working than those in the raw material, public utility, and food production groups served by one or other of the Benn journals—the timber, chemical, leather, gas, electrical, fruit-growing, and milling industries. It will be our privilege to supply harassed managers and technical staffs with all the information of markets and processes at our disposal. The full value of that offer, however, will only be realised if accompanied, as it is, by our promise to exert every ounce of our strength to free them not only from direct Government control but from indirect restrictions of every kind at the earliest practicable moment. We know that this is the wish of the commercial world in overwhelming degree. It has no illusions about the complete artificiality of the apparently prosperous war-time structure. State planners may find some resemblance between their economic paradise and the present position in which it is far more difficult to get staff than business, but there is so much paper in the structure that there is a risk of its collapsing headlong when external competition is resumed. And there is as much sense in thinking of the earth without the sun as of commerce without competition.

Mr. Norman French, joint managing director, seconded the motion, which was carried, as was the board's recommendation that a final dividend of 12½ per cent. should be paid on the ordinary shares, making 17½ per cent. for the year. Sir Ernest Benn was re-elected a director of the company.

Drying Paint by Town Gas

Portable Generator Units

A RECENT development in the application of town gas to paint finishes is the Cyclone Generator used in the "Plastoglaze" process developed by Plastic Spray, Ltd. The process of stoving paint finishes on large objects presents serious difficulties, with both infra-red and the normal convection oven, as an oven capable of taking the largest object must be installed. This new development claims to overcome these difficulties entirely. The paint is sprayed in the normal way and dried in a few minutes by the application of hot air containing products of combustion at a temperature of 176° C.



The unit designed for this purpose had to be mobile (*see* the illustration herewith) and the air as free as possible from dust.

Types of Cyclone Generator unit available are as follows: (a) No. 2/S (stationary). Output: 10,000 cu. ft. of hot gases per hr.; consumption: 0.45 therms of town gas per hr. (b) No. 2/M (mobile), equipped with wheels, 20 ft. of asbestos-lagged flexible metal hose, round outlet and handle; output and consumption as for No. 2/S. (c) No. 3/S (stationary). Output: 30,000 cu. ft. of hot gases per hr.; consumption: 1.25 therms of town gas per hr. (d) No. 3/M (mobile), equipped with wheels, 60 ft. of asbestos-lagged flexible metal hose, four round outlets and handles; output and consumption as for No. 3/S. Special outlets can be manufactured to meet individual requirements.

The advantage of this system for very large surfaces or a heterogenous collection of objects is obvious. The finish obtained is said to be equal to that produced with synthetic paints stoved by infra-red or convection methods and the constitution of the varnish coupled with the high rate of air change gives a wide latitude of safety and freedom from pinholes. The "Plastogiaze" process is patented by Plastic Spray, Ltd., who grant a free licence for its use with the units sold.

The Cyclone Generator is compact and efficient and has uses other than the specialised paint drying for which it was designed. Test experiments have been made on drying processes, and particularly on the removal of water from metal objects after hydraulic test. The application of the unit to the so-called false stoving of aeroplane parts is particularly important. Further details, including prices, can be obtained from Plastic Spray, Ltd., 3 Vere Street, London, W.1.

Organic Chemical Markets

An American World Survey

IN a recent report from the Chemical Unit of the Bureau of Foreign Commerce, Washington, it is stated that U.S. production of organic chemicals in 1942 was 2½ times that of 1937; but, despite a very considerable percentage increase in exports in 1941 over 1937, only a comparatively small proportion of the total production (less than 4 per cent.) was exported in 1941, as shown in the table below. Export figures for 1942 were apparently not available at the date of this report. The American chemical industry has not greatly interested itself hitherto in the export business, and is now adjured to wake up to the vast possibilities in this direction. It is thought that the figures for 1941, though small compared with the total production and the huge demands of the home market, are encouraging:

	1937 ($1000)	1941 ($1000)	Percentage increase
Europe (total) ...	8257.8	9870	20
U.K.	2073.3	8086.4	290
Russia	44.2	516.6	1067
Switzerland ...	106.6	446.5	320
N. America			
Canada	4825.4	13225.6	174
Mexico	698.3	2699.0	286
S. America (total) ...	1435.6	9832.5	585
Argentine	363.4	2764.0	661
Brazil	367.1	3021.7	793
Chile	255.6	1492.5	484
Columbia	221.3	1189.0	437
Asia (total)	5616.7	12441.7	122
China	2021.0	990.0	−50
India	319.5	4841.8	1415
Dutch East Indies...	86.6	3816.3	4303
Africa (total)... ...	338.8	2035.2	501
South Africa ...	219	1208.4	452
Egypt	7.2	385.8	5215
Belgian Congo ...	3.1	127.2	4030

Large percentage increases were also recorded for Australia and New Zealand. In the case of the U.K., Russia, Egypt and India, the higher values shown are no doubt due very largely to war exigencies under the Lend-Lease agreements, but this does not apply to South America, Mexico, Dutch East Indies, etc.

It is thought that, at the end of the war, there will probably be sufficient immediate military and urgent civilian need to absorb much of the organic chemical industry's surplus; but by about 1948 it is predicted that U.S. exports will have increased by 68 per cent. in dollar value over the 1937 aggregate figure of $139,500,000. Further, the coal-derived chemical groups will probably have increased by 44 per cent. over the 1937 figure of $14,900,000. These substantial gains are based on a study made by the Bureau of Foreign and Domestic Commerce, and are included in the Bureau's publication *Foreign Trade After the War*. Although the position of Germany, and especially of the European Dye Cartel, after the war, is uncertain, the general view is that Germany and the other European countries may act rather as competitors than as customers in the world markets.

The post-war prospects for trade in Asia, Oceania, and Africa are also at present a little obscure; but with Japanese competition presumably greatly reduced for some years there should be large opportunities in China and India. Australia, New Zealand, and South Africa, although increasingly industrialised, will doubtless require large imports of chemicals.

The South American Field

The chief field for expansion of American exports is no doubt South America. It is suggested that growing industrialisation there should be welcomed by American manufacturers, for thus will the South Americans' purchasing power increase, and especially their requirements in high-grade chemicals, which they will probably be unable to supply from their own factories. Speaking in further detail of the anticipated results of increasing industrialisation in Mexico, Brazil, Argentina, Chile, and Peru, the report states that the outlook for sale of American organic chemicals is particularly favourable, especially in view of the growing plastic, textile, soap, and other heavy chemical industries in those countries. It is emphasised that foremost among the conditions of successful selling campaigns is intelligent servicing—a point that is at last beginning to be appreciated in Britain also, as will be seen from the leading article in this week's issue.

A leading American technical journal, in an editorial on the subject, expresses the view that U.S. producers of chemicals may congratulate themselves on having passed all competitors in this field, and that vast opportunities for expansion of export trade await energetic and intelligent exploitation.

Regulations have been made adding preparations of penicillin to the Schedule to the Therapeutic Substances Act as being substances the purity or potency of which cannot be adequately tested by chemical means. Any person manufacturing a penicillin preparation for sale must obtain a licence and comply with the prescribed conditions as to strength, quality and purity. Applications for licences should be addressed to the Ministry of Health, Whitehall, London, S.W.1, the Department of Health for Scotland, St. Andrews House, Edinburgh, 1, or the Ministry of Home Affairs, Stormont, Belfast.

U.S. Helium Production

Twenty-Five Times Pre-War Output

PRODUCTION of helium in the United States is now 25 times the pre-war output, states an article in *Chem. Met. Eng.*, June, 1944 (p. 92). At the same time, improvements in extraction methods and increased efficiency of operation have reduced the production cost of helium to about 1 cent per cu. ft. A $16,000,000 helium programme organised by the Bureau of Mines brought into production two new plants last year and another two this year, while the plant at Amarillo, Texas, has been expanded. Production is now 25 times the pre-war output. At the same time, improvements in extraction methods and increased efficiency of operation have reduced the production cost of helium to about 1 cent per cubic foot.

The helium content of the incoming natural gas at various plants operated by the Bureau ranges from 1 to 7 per cent. The first step in the process of helium extraction is the removal of small quantities of carbon dioxide and water vapour contained in the helium-bearing natural gas, and the removal of hydrogen sulphide, if any. Usually, the carbon dioxide comprises only about ¼ per cent. of the volume of the untreated gas, but some gases contain larger percentages. According to the capacity of the plant and the carbon dioxide content of the gas, the weight of carbon dioxide removed may total several tons a day.

Initial Purification

The carbon dioxide and water vapour are removed from the incoming natural gas by a scrubbing operation which employs a mixture of solutions of monoethanolamine and diethylene glycol. These chemicals are reclaimed later by the addition of heat which releases carbon dioxide, hydrogen sulphide, and water. The removal of carbon dioxide, water vapour, and hydrogen sulphide (if present) is effected at about 650 lb./sq. in. By use of countercurrent heat exchangers the natural gas, freed of carbon dioxide and water vapour, is cooled progressively to − 185° C. At that temperature, and under a pressure of about 300 lb./sq. in., all the constituents of the natural gas, except helium and a small amount of nitrogen, are liquefied. The liquids then are withdrawn from the apparatus and sent back through the heat exchangers, and are warmed to room temperature by the incoming gas. The crude helium, which has remained in a gaseous state throughout the operation, is withdrawn at the top of the equipment for further purification.

The initial refrigeration of the natural gas and the gas needed to continue the process is produced primarily by means of an expansion-engine cycle. Nitrogen that has been separated from the natural gas is compressed to about 600 lb./sq. in. and expanded through the engine. The engine runs a hydraulic brake or "hydrotarder" which provides a means for the removal of heat energy from the nitrogen. The temperature of the exhaust from the engine is about 85° C. lower than the temperature of the inlet high-pressure gas and this exhaust is employed to cool the nitrogen flowing to the engine. The nitrogen is thus cooled progressively until a sufficiently low exhaust temperature has been reached. The nitrogen refrigeration cycle is entirely separate from the natural gas cycle.

The Final Product

Helium of about 50 per cent. purity is produced in the operation, the impurity being nitrogen. High-purity helium could be produced in one operation, but as helium is soluble in the liquefied natural gas and as high pressures are required for the production of high-purity material, appreciable quantities of helium would be lost through solubility. To avoid such losses, the final product, which has a purity of more than 98 per cent., is produced in two steps. These steps, although distinct, are similar as to method and are carried on simultaneously. The second cycle, which operates at a pressure of 2500 lb./sq. in., discharges the purified helium directly into tank cars or other shipping containers without any further compression. Modern containers for helium are in the form of seamless steel cylinders mounted on special railway wagons.

Most of the helium is allotted to the Navy for giving buoyancy to blimps on patrol against U-boats. The requirements of the Army are also met. Some helium is used in anaesthetics, in deep-sea diving, in treatment of respiratory illnesses, and in a new welding process for magnesium aircraft parts.

An interesting review of the industrial chemical history of Merseyside during the last 100 years was given to the Widnes Rotary Club last week by Councillor John Williams, J.P., manager of the Castner-Kellner Works, and a director of I.C.I. (General Chemicals), Ltd., who this year completes 51 years' service in the industry. He attributed much of the rapidity and ease with which the industry had developed to the ready adaptability of the workers to the multitude of changes that had taken place.

Personal Notes

MR. C. T. GIMINGHAM, O.B.E., B.Sc., F.R.I.C., has succeeded Mr. J. C. F. Fryer as director of the Ministry of Agriculture's Plant Pathological Laboratory.

Owing to the pressure of other work, MR. A. J. GIBSON, acting hon. chairman of the British Shellac Bleachers' Association, is relinquishing his connection with the Association on September 30. Communications after that date should be addressed to the deputy chairman, Mr. A. F. Suter, of Messrs. A. F. Suter & Co., Victory Works, 83/84 Eastway, Hackney Wick, London, E.9, until further notice.

The Council of the Royal Institute of Chemistry has decided that the offices of registrar and secretary of the Institute, previously held by Mr. Richard B. Pilcher, shall be separated. To the office of registrar, the Council has appointed MR. R. LESLIE COLLETT, who has been assistant secretary for nearly 20 years, and to the office of secretary, DR. H. J. T. ELLINGHAM, of the Imperial College of Science and Technology. Both appointments will take effect from January 1, 1945.

PROFESSOR J. L. SIMONSEN and PROFESSOR SIR ROBERT ROBINSON have now reached the Caribbean area on their mission to discuss fundamental problems of research on new uses for Colonial raw materials, with specific reference to the co-ordination of the work of the Colonial Products Research Council with that of the Caribbean Research Council (created last year to provide technical and scientific advice). Before going to the Caribbean the two scientists visited Canada, where they attended a conference of British Commonwealth scientific officers in North America, and the United States, where they planned to establish contact with officials of the U.S. Department of Agriculture interested in similar research, and to see certain centres where research is being carried out into chemical uses of agricultural by-products.

Obituary

MR. PHILIP E. HILL, the financier, who died on August 15 at Windlesham, Surrey, aged 71, was chairman of Beechams Pills, Ltd., Beecham Maclean Holdings, Ltd., and several of their subsidiary companies.

The death has occurred at Redhall, Barrhead, of MR. ALLAN KIRKWOOD, J.P., who until his retirement was head of the firm of Allan Kirkwood, Ltd., Arden Lime Works, Nitshill, Renfrewshire. For a long period he represented Hurlet on the Renfrewshire County Council.

Silicosis in Foundries

Inquiry Committee's Report

THE incidence of silicosis in steel foundries has been on the increase, and in 1943 the Factory Department of the Ministry of Labour and National Service appointed a committee to investigate the position with a view to recommending further precautions that might be taken to protect workers against the risk of exposure to silicosis dust. The committee, which includes representatives of the employers, the workmen and the Factory Department, has just produced its first report, under the title of *Dust in Steel Foundries* (H.M.S.O., 6d.). The recommendations made by the committee include the following. The use of parting powders containing free silica should be prohibited. As soon as sufficient quantities of suitable alternative non-siliceous materials are available, no material containing free silica should be used as a constituent of steel moulding compositions; similarly, the use of silica-containing paints on the surfaces of moulds or cores should be prohibited as soon as possible.

Dealing with sand-blasting operations, it is recommended that no sand or other substance containing free silica should be introduced as an abrasive in any blasting apparatus, while any sand or dust arising from blasting should be separated from the abrasive material before the latter is used again. The report also covers such matters as the provision of proper ventilation, protective helmets, etc.

METALLURGY CERTIFICATES

It had been expected that the scheme for National Certificates in Metallurgy, in which the Iron and Steel Institute, the Institution of Mining and Metallurgy and the Institute of Metals are co-operating with the Board of Education, would be launched in time to allow colleges and schools to start their courses in the academic year beginning September, 1944. This has, unfortunately, proved impracticable. The scheme will now come into operation so that courses will begin in September, 1945, and the first examinations for the Ordinary Certificates will be held in 1946. Colleges and schools are being advised to this effect by the Board of Education, so that as much progress as possible can be made in anticipation.

The first meeting of Manchester's Joint Research Council, to bring science and industry into closer relation, will be held on October 9 at Manchester University.

Pest and Weed Control

Some New American Patents

A NEW method for controlling termites and other insects, as well as economically-harmful fungi, bacteria, and moulds is contained in U.S.P. 2,343,415, assigned to Du Pont's by F. H. Kaufert, of St. Paul, Mo. His method makes use of either 2-chloro- or 4-chloro-6-nitrotoluene, or a mixture of the two. A concentrated emulsion for preparing dilute sprays may be prepared by blending 22½ parts of the chloronitrotoluene with 2½ parts of *o*-dichlorobenzene and 25 parts of straw paraffin oil to form a clear solution. This solution is emulsified in 49 parts of a casein-borax solution prepared from 3 parts of borax and 6 parts of casein per 100 parts of water. One part of sodium lauryl sulphonate is also included. This emulsion is applied to the soil in a dilution of 1 to 2 parts per 2 parts of water.

A preparation, effective for killing certain weeds without harming cereal plants, is obtained by combining 1 part of 2,6-dichloro-4-nitrophenol with 2½ parts of urea. The ratio of urea to the former compound may be as much as 4 to 1. This proportion of ingredients along with 3 parts of water is heated while stirring until solution takes place. The compound, which crystallises on cooling, is the urea double compound. It is soluble in water in the concentrations used for weed-spraying, that is, 1 or 2 per cent. (U.S.P. 2,344,063 to H. Schotte *et al.*, vested in the Alien Property Custodian).

Theobromine in Spain

Raw Material Allocations

ACCORDING to an article by Dr. Julio P. Davila in a recent issue of the chemical journal *Ion*, the Spanish firm of Davur S.A. is manufacturing theobromine. The company placed this drug on the market in May, 1943. Owing to the lack of suitable decolorising carbon, the material was of a greyish colour, but complied with the requirements of the Spanish Ministry of Health in respect of its therapeutic qualities. The first offerings of the home-made product had the effect of bringing on the market some parcels of foreign origin, which had been previously withheld and kept in storage in Barcelona, presumably with the idea of getting higher prices. By a decree made in March, 1944, the Ministry of Commerce prohibited importation of theobromine for the time being.

Owing to the somewhat scattered nature of the chocolate manufacturing industry in Spain, the provision of adequate quantities of cacao shell presents some difficulties. However, with the help of the Ministry of Industry and Trade, allocations of raw material for theobromine manufacture were made as follows: 120 tons in 1942-3, 400 tons in 1943-4, and 500 tons (1660 kg. per day) in 1944-5. Yields of theobromine from this material vary from 0.2 per cent. to 1.0 per cent. At first the Davur company was only able to get 0.2-0.5 per cent. yields, but they have now improved the yields up to 0.7 per cent. The price at first obtained—975 pesetas per kg.—was unprofitable, only the hope of improved yields and better supplies of raw material inducing the firm to continue.

Chemical Industry in France

Saint-Gobain Report for 1943

AN abbreviated version of the annual report of the Manufactures des Glaces et Produits Chimiques de Saint-Gobain, Chauny, et Cirey, usually referred to as Saint-Gobain, one of the four leading French chemical groups, has just been received in this country. In the year under review, transport difficulties and the strained raw material position affected the majority of the company's activities. The production of sheet glass, to begin with, one of Saint-Gobain's chief interests, had to be almost entirely suspended. The production of other types of glass and of insulating materials suffered badly owing to the lack of fuel. On the other hand, good progress was made in the production of glass fibres for the textile industry. Satisfactory results are reported from the Swiss subsidiary, where the glass output was unaffected, and the group's Rumanian interest shows satisfactory results.

The production of chemicals was severely affected by the discontinuation of imports of phosphates from North Africa. The cessation of the production of phosphate fertilisers is referred to, with its inevitable repercussions on the manufacture of a number of other products, notably on that of sulphuric acid. Only the production of sodium carbonate and the manufacture of "Gobanyle" were maintained, while output of chloro-compounds as well as of copper and aluminium compounds declined, owing to the scarcity of raw materials.

The net profit of 36 million francs was transferred entirely to reserves for re-equipment. The dividend—reported already in our issue of June 3—was derived from certain reserve funds. At the general meeting, the Board obtained authorisation to increase the present capital of 675.5 million francs by 500 million francs. This increase will, according to comments, serve to strengthen the group's position after the war, when large amounts will be required to replenish stocks, to renew plant, and to initiate new lines of production.

General News

The Control of Iron and Steel (No. 35) Order, 1944, published as S.R. & O. 1944, No. 909, came into force on August 15. Details will be published in our next metallurgical section.

Owing to enemy action, Mr. H. A. Cook, consulting chemist and chemical engineer, requests his clients to forward samples for examination or analysis to 9 Oaklands Avenue, Oxhey, Herts.

Four more subsidiary fertiliser companies are being liquidated at the end of this month, in addition to those mentioned in our issue of July 8, in connection with the reorganisation of Fisons, Ltd.

The Department of Health for Scotland last year organised the collection of 40 tons of seaweed of the type required for the preparation of bacteriological agar, while 70 tons of rose-hips were gathered and converted into syrup.

The Trade Union Congress is being pressed to revive its Scientific Advisory Committee. This committee came into being a few months before the war, but has so far never had a chance to fulfil its advisory function.

The memorandum on medical supervision in factories (Form 327) has been revised by the Factory Department, and can be obtained from the Stationery Office, price 2d. It includes a reference to the essential part that works' medical officers will have in any schemes for the reconditioning and resettlement of disabled persons in industry.

Reconstruction of the out-patients' department of the former Queen's Hospital, Birmingham, now the Birmingham Accident Hospital and Rehabilitation Centre, has been completed, and the department was declared open by the Minister of Health on Monday. This great constructive venture has proved necessary on account of the large increase in the number of industrial accidents due to the war-time employment of many persons unused to factory life.

Officials of the British, American and Dutch Governments, assisted by members of various branches of the industry, have now concluded exploratory conversations on post-war rubber problems. A comprehensive survey has been made of the rubber situation, covering both natural and synthetic rubber, and in the course of these discussions a full exchange of views took place and a large measure of agreement was reached. A first programme of studies has been prepared and arrangements for carrying out these studies are being made. The conversations will be resumed in the near future.

From Week to Week

Radio frequency power and its potentialities for processing chemical materials is the subject of a useful article by J. W. Robertson in *Ind. Eng. Chem.*, May, 1944, p. 440. This account gives further details of the technique described in THE CHEMICAL AGE a year ago (1943, *49*, p. 210) and a reading list of 56 references.

Foam slag as a building material appears to be receiving a good deal of attention in Scotland. A block of four four-apartment houses have been built by the foam-slag block process at Penilee, and these will be on public view next week. According to Mr. George Smith, convener of Glasgow's housing committee, the factory which is making the blocks could produce enough for 4000 houses a year.

The national standardising bodies of the United Nations have agreed, as a temporary measure, to establish a United Nations Standards Co-ordinating Committee. The standards sponsored by this committee will provide agreed methods for expressing and testing the properties of materials and appliances. Approval of the scheme has already been received from the standardising bodies of Britain, Australia, Canada, South Africa and the United States. Offices have been set up in London (19-21 Palace Street, S.W.1) and New York.

Comment upon the amount of publicity given to research during recent months was made by Dr. P. C. C. Isherwood in his chairman's statement circulated with the reports and accounts of W. J. Bush & Co., Ltd. "Much has been written lately on the importance of research and a layman might be pardoned for thinking that research with a big 'R' is a new invention. As a matter of fact your company, in common with all other progressive chemical concerns, has for very many years devoted much time to this vital side of the business and much of our success has been due to this activity," he remarked.

The Ministry of Supply has prepared a third supplement to the *Raw Materials Guide*, and this can be obtained, price 1d., from the Stationery Office. In it the announcement is made that the work of the Miscellaneous Chemicals Control (other than paints) has been absorbed in the headquarters of the Raw Materials Department, 6 Carlton House Terrace, S.W.1 (WHItehall 4341). Among new items introduced into the Guide is DDT which, it is stated, is now being produced in the United Kingdom under Government control; all production is reserved for essential Service requirements and inquiries are the concern of R.M.2C., 6 Carlton House Terrace, London, S.W.1.

A consolidating Order, entitled the Trading with the Enemy (Specified Persons) (Amendment) (No. 9) Order, 1944 (S.R. & O. 1944, No. 810, price 4s.) consolidates all existing Specified Persons Orders up to and including the No. 8 Order of 1944.

Among the names of approximately 200 firms and persons in neutral countries with whom dealings of any kind are illegal, listed in the Trading with the Enemy (Specified Persons) (Amendment) (No. 10) Order, 1944 (S.R. & O. 1944, No. 899), the following are of special interest to the chemical and allied industries: Fabrica Industrial Química, Soc. Ltda., Valparaiso and Viña del Mar, Chile; Casa Bayer, all branches in Colombia; Empresa Revendedora de Anilinas, Ltda., Rua Carlos Mardel, Lisbon; Industrias Reunidas Minero-Metalúrgicas, S.A., Bilbao; and Munot-Bleikristall-Raffinerie Schaffhausen, E. Paukner, Schaffhausen, Switzerland. About 100 names are removed from the Black List, including: Schering Produtos Químicos e Farmacéuticos S.A., all branches in Brazil; and Sociedade Continental Metalúrgica, Ltda., Rua das Pedras Negras 3, Lisbon.

Foreign News

The Turkish Government is planning to erect two oil refineries with a combined annual capacity of 100,000 tons.

Price of vitamin B, in the United States, is now 20 cents a gram, as against $300 in 1935.

The American Society for Testing Materials has appointed a standing committee representative of producers, consumers, and scientific investigators interested in the subject of powder metallurgy.

I.G. Farben Industrie A.G. has again declared a dividend of 6 per cent. As in previous years, no information is being revealed regarding financial results and production.

American firms producing DDT include Cincinnati Chemical Co., (associated with Geigy Co. of Basle, Switzerland), Merck & Co., Monsanto Chemical Co., Hercules Powder Co., du Pont de Nemours & Co., and Elko Chemical Works.

The principal change in the German-Swiss economic agreement which has just been ratified by the Swiss Government, and prolonged until December 31, is to the effect that deliveries of mineral oils, "owing to circumstances," are to be the subject of new discussions.

The War Production Board, Washington, has authorised the use of lead-free zinc oxide in the manufacture of laboratory reagent chemicals, cellulose, nitrate plastics, vulcanised fibre, and toilet soap. The new order also states the types of paint in which lead-free zinc oxide may be used.

The Chemical Warfare Service of the U.S. Army has allocated a sum of $670,000,000 for the fiscal year 1945, and it is expected that about $4,000,000 will be spent on research.

The Swedish pulp industry has made such progress that Sweden is now independent of imports of cell-wool, especially since the establishment of the new pulp factory in Alvenäs in Värmland.

Chloroformic acid esters of methanol, propanol, butanol, and amyl alcohol are being made on pilot-plant scale by U.S. Industrial Chemicals, Inc. Ethyl chloroformate has been made by the firm for many years.

Details of a process for converting glycerol into dihydroxyacetone by means of *Acetobaster suboxydans,* with an efficiency approaching 100 per cent., are published in *J. Amer. Chem. Soc.,* July, 1944, p. 1183.

The University of British Columbia is planning post-war extensions to cost $4,000,000, of which $1,000,000 will be spent on the erection of a new science wing and $100,000 on expansion of the mining and metallurgy department.

Several new factories have been established in Slovakia for the production of synthetic fibre from wood pulp, a material in which the country is very rich. Production will be more than the domestic market can absorb, and export markets will be sought.

The suggestion that the Belgian Congo should increase the mining of tantalum ores has come from the U.S.A., which stands in need of tantalum. A special organisation has been set up to find new mines in various parts of Africa now that the winning of tantalum ores in Australia is on the downgrade.

A new nitrate plant is being built in Chile by the Tarapaca & Antofagasta Nitrate Co. of Santiago. Fully mechanised, it will have an annual capacity of 200,000 tons to begin with, though it is expected that this will later be raised to 300,000 tons. Assuming the latter figure, there is sufficient nitrate in the company's own ground to last 25 years, while within a radius of 10 miles there are reserves amounting to 70,000,000 tons of nitrate.

A report on zinc deposits in the Mount Eielson district, Alaska, has been published by the U.S. Geological Survey. Some 100,000 tons of ore on the site are inferred, which contain an average of 5 per cent. of zinc., 3 per cent. of lead, 0.2 per cent. of copper, and between one and two oz. of silver per ton. In addition, approximately 90,000 tons of ore averaging more than 5 per cent. of zinc and 5 per cent. of lead, are estimated from the talus deposits.

Extraction of rubber from the common milkweed, which has a rubber content of about 0.4 per cent., is described by N. H. Grace, J. Klassen and R. W. Watson, of the National Research Council of Canada, in an article published in the American journal, *The Rubber Age* (1944, *55*, 3, p. 259). The extracted material when mixed with synthetic rubber (GR-S) in the proportion of 15 parts to 85, resulted in a tyre-tread compound which showed improved tack, increased tear resistance, reduced tensile strength, modulus and resilience; the heat-embrittlement figure and flux life were both improved.

The Department of Land and Mines, Tanganyika Territory, has published a bulletin, No. 16, dealing with mica production. The view is expressed that a reliable local marketing organisation needs to be established on a scale large enough to effect rationalisation of Tanganyika's mica industry. Paucity of capital to promote such an undertaking in spite of the demand that must exist for this important strategic mineral is believed to be due not so much to the incidence of war risks as to the powerful restraining influence exercised by vested interests in the mica industry in the United Kingdom.

The U.S. Alien Property Custodian has issued an order demanding the surrender by the Standard Oil Co. (N.J.) of 20 per cent. of the outstanding stock of the Standard Catalytic Co., 50 per cent. of the outstanding stock of Jasco, Inc., and 25 per cent. of the stock of the Hydrocarbon Synthesis Corp. The securities involved were formerly the property of I.G. Farbenindustrie A.G., and the three American corporations were organised to operate in the United States certain patent pooling arrangements sponsored jointly by that company and Standard Oil. The order applies also to approximately 675 patents and about 100 applications for patents, many patents covering the production of synthetic rubber being held by Jasco, Inc.

The viscosity of pectin solutions has been the subject of some study at the West Regional Research Laboratory of the U.S. Department of Agriculture. According to a paper by H. S. Owens, H. Lotzkar, R. C. Merrill and M. Peterson, in *J. Amer. Chem. Soc.*, July, 1944, p. 1178, the viscosity of dilute pectin solutions increases to a maximum as the *p*H is adjusted to a value near 6. The viscosity can be reduced to a minimum value by the addition of acid, or sodium chloride. As the concentration of pectin is increased above 0.5 per cent. the relative viscosity is practically unaffected by changes in *p*H in the range 1-7. Urea up to 0.5 molal concentration has little effect on the relative viscosity of pectin solutions.

Forthcoming Events

The **Institution of Chemical Engineers** is holding a joint conference with the **Institute of Physics** and the **Chemical Engineering Group** at the Royal Institution on **September 22** and **23.** The subject is "Instruments for the Automatic Controlling and Recording of Chemical and other Processes." Further particulars are obtainable on application to the Organising Secretary Joint Conference, Institution of Chemical Engineers, 56 Victoria Street, London, S.W.1.

Company News

Beechams Pills, Ltd., are making an interim distribution of 7½ per cent. (same), payable September 30, for the year to March 31, 1945.

"Sanitas" Trust, Ltd., are repeating the 12½ per cent. ordinary dividend for the year ended May 31. Net profit was £58,257 (£58,224).

Sangers, Ltd., whose increased dividend has already been reported, have recorded a profit of £272,779 (£231,515) for the year to April 30.

New Companies Registered

Production Chemicals (Rochdale), Ltd. (389,109).—Private company. Capital: £2000 in 2000 shares of £1 each. Objects: To carry on the business of manufacturers of and dealers in chemicals, drugs, oils, colours, dyes, etc. Directors: E. S. Lord; Gladys M. Markman; C. E. Garnett. Registered office: Lloyds Bank Chambers, Lord Street, Rochdale.

Diacut (Leicester), Ltd. (389,161).—Private company. Capital: £2000 in £1 shares. Hardeners and processors of steel, metal workers, manufacturers of and dealers in diamond impregnated plastics and goods made therefrom, soap, cleaning and polishing materials, chemicals, etc. Directors: D. McPherson; H. Daft. Solicitors: Sydney Payne and Treath, Leicester.

Chemical and Allied Stocks and Shares

STOCK markets have been less active and slightly reactionary, the excellent war news having tended to centre market attention on the conflicting views which are current with regard to post-war prospects of individual companies and the difficulties that will arise in switchover to peace-time working. There has been no heavy selling, and declines on balance were mostly small. In fact, many shares of companies connected

with the chemical and allied industries had a relatively steady tendency.

Imperial Chemical at 40s. 1½d. were little changed on balance, while B. Laporte were again 85s. Lever & Unilever were 42s., and W. J. Bush ordinary remained firmly held and quoted at 66s.; the yield on the latter shares is only 3 per cent., based on the 10 per cent. dividend ruling since 1938, but this has to be considered in relation to the fact that earnings on the shares have been much in excess of this rate. The recently-issued results showed that, if profits had been fully distributed, the dividend could have been over 50 per cent. The company also has an issue of 5 per cent. £5 preference shares, whose dividend is covered many times over, and at £5⅝ the yield is fully 4⅜ per cent.; these shares are, however, firmly held, and might be unobtainable except at a higher price than that indicated by the current quotation. After rising to over 50s., Dunlop Rubber eased to 49s. 9d., while British Aluminium at 51s. 9d. and British Oxygen at 88s. 9d. have also not held best levels. British Plaster Board at 39s. 9d. moved back slightly. Triplex Glass at 45s. 9d., Wall Paper deferred at 46s. 3d., and Pinchin Johnson at 41s. 7½d. also reflected the easier tendency of markets. Boots Drug at 57s. 3d. lost part of their recent advance. Sangers were steady at 29s. 1½d.; the directors state in their report that they propose to increase the interim dividend, but this must not be taken as indicating any increase in the total payment for the current year. Textiles became easier, including British Celanese and Courtaulds, although Calico Printers remained firm on hopes that the results may announce an increased payment in respect of preference dividend arrears. Bleachers ordinary were better at 12s., and Bradford Dyers little changed at 25s.

Elsewhere, Borax Consolidated showed steadiness at 40s. 3d., as did British Match at 45s. and Murex at 103s. 9d., although Turner & Newall eased to 85s. 9d. Barry & Staines were well maintained at 54s. 3d., and Nairn & Greenwich were 78s. 9d. United Molasses showed firmness at 39s 6d. De La Rue eased to £9 7/16ths, but Erinoid 5s. ordinary were steady at 11s. 6d., and British Industrial Plastics 2s. ordinary again 7s. 9d. Amalgamated Metal were maintained at 18s. 7½d., General Refractories at 18s. 3d., and Imperial Smelting at 14s. 6d. Shares of the Metal Box Co. at 94s. 3d. were little changed on balance. Iron and steels were easier, with United Steel 26s. 6d., Dorman Long 28s. 3d., Consett 8s. 9d., and Richard Thomas 12s. 9d. Stewarts & Lloyds deferred were 58s. 6d., and Tube Investments 100s. 6d. Babcock & Wilcox eased to 53s. 6d.

British Drug Houses kept firm at 29s., Burt Boulton were 24s. 6d., and Cellon 5s. ordinary 25s., while Greeff-Chemicals 8s. ordinary were 8s. 6d., Goodlass Wall 10s. ordinary were 19s. 9d., United Glass Bottle 72s., and Associated Cement 71s. Oil shares showed a general advance on the prospect of the post-war position of the industry being assisted by agreements between the leading producing countries. Shares of the Trinidad oil companies were particularly favoured, but owing to easier markets, best prices were not fully maintained.

British Chemical Prices

Market Reports

QUIET conditions have been in evidence in some sections of the London market, which can be accounted for by the usual tendency towards slackness at this time of the year. There has been no change in the supply position, but deliveries against contracts are reported to be satisfactory. In the soda products section fresh inquiry is reported for bicarbonate of soda, and a continued scarcity of supplies of yellow prussiate of soda is reported. Glauber salt and salt-cake are an active market and a good inquiry has been made for industrial refined nitrate of soda. A steady trade is passing in both the photographic and technical grades of hyposulphite of soda. In the potash section, yellow prussiate and bichromate of potash are scarce, and permanganate of potash is in strong request. A good demand is reported for supplies of acid phosphate of potash. In other directions items such as boric acid and hydrochloric acid are in good request, and scarcity of supplies is reported in respect of oxalic, citric, and tartaric acids. Conditions in the coal-tar products market are a little less active than of late, although there is no falling off in contract deliveries. Creosote oil and crude carbolic acid are in strong demand, while the xylols, toluols, and benzols are steady and firm, and naphthalene is in good call.

MANCHESTER.—The Manchester market for heavy chemical products has been a shade more active during the past week, but seasonal conditions are operating locally to a marked degree, a large number of consuming centres, both in Lancashire and the West Riding, being on holiday. This continues to have an adverse effect on the aggregate movement of materials against orders already placed and also on the amount of fresh business, which has been on only a moderate scale. In the by-product market fair quantities of the leading light and heavy products are finding an outlet at a generally firm range of prices.

GLASGOW.—In the Scottish heavy chemical trade there has been a marked improvement in home business during the past week on account of the annual holidays now having been completed. Export inquiries are rather restricted. Prices remain firm.

The fact that goods made of raw materials in short supply owing to war conditions are advertised in this paper should not be taken as an indication that they are necessarily available for export.

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HORIZONTAL all copper **AUTOCLAVE**, 6 ft. 3 in. long by 3 ft. 0 in. dia., with stirring gear, driven from belt pulley; horizontal agitating shaft running through glanded bolted-on end covers; 6 in. dia. opening in top.

Vertical lead lined **HIGH PRESSURE AUTOCLAVE** or **ACID EGG**; mild steel casing 4 ft. 8 in. deep by 3 ft. 0 in. dia., lined ¼ in. lead; fitted massive hinged lid arranged 14 quick-acting swing bolts; various connections.

Horizontal steam jacketed **HIGH PRESSURE STIRRED AUTOCLAVE** by Lennox Foundry; cast iron body 4 ft. 4 in. long by 2 ft. 0 in. dia., with mild steel jacket; cast iron bolted-on end covers with glanded agitator shaft carrying heavy stirring blades; direct driven from f. and l. pulleys.

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None of the advertisements below relates to a woman between 18 and 41 unless such a woman (a) has living with her a child of hers under the age of 14, or (b) is registered under the Blind Persons Acts, or (c) has a Ministry of Labour permit to allow her to obtain employment by individual effort.

ANALYST required for permanent position in heavy chemical firm in the North West under the Essential Work Order. A University degree or its equivalent is essential, together with experience in inorganic chemical analysis. Salary according to qualifications and experience. Apply Box No. 2180, THE CHEMICAL AGE, 154, Fleet Street, E.C.4.

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